Occurrence of Leatherback Sea Turtles (*Dermochelys coriacea*) off the Pacific Coast of Canada, 1931-2009

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by

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ABSTRACT

Spaven, L.D., Ford, J.K.B., and Sbrocchi, C. 2009. Occurrence of leatherback sea turtles (*Dermochelys coriacea*) off the Pacific coast of Canada, 1931-2009. Can. Tech. Rep. Fish. Aquat. Sci. 2858: vi + 32 p.

Little is known of the occurrence and distribution of leatherback sea turtles (*Dermochelys coriacea*) in the waters off British Columbia (BC), Canada. In order to acquire baseline data essential to directing future research and recovery efforts, we compiled and evaluated current and historical occurrences of leatherbacks in the region. This report summarizes 119 leatherback turtle sightings documented from 1931 to 2009 and research efforts undertaken by Fisheries and Oceans Canada during 2002-08 within Pacific Canadian waters. Sightings information was collected through surveys, questionnaires, and an educational outreach campaign. In 2003, a questionnaire was mailed to approximately 1500 mariners and coastal aircraft pilots soliciting leatherback turtle sightings. Sighting effort for leatherbacks was maintained during 21 ship-based surveys for cetaceans off the BC coast during 2002-2008, and 4 dedicated aerial surveys conducted in 2005-2007. Sightings of leatherback turtles were scattered throughout Canada's Pacific coast and suggest that leatherbacks occur seasonally between late summer and early fall with the greatest number of sightings in August.

RÉSUMÉ

Spaven, L.D., Ford, J.K.B., and Sbrocchi, C. 2009. Occurrence of leatherback sea turtles (*Dermochelys coriacea*) off the Pacific coast of Canada, 1931-2009. Can. Tech. Rep. Fish. Aquat. Sci. 2858: vi + 32 p.

Il existe peu de données sur l'occurrence et la distribution des tortues luth (*Dermochelys coriacea*) dans les eaux de la Colombie-Britannique. En vue d'établir une base de référence qui permettra d'orienter les travaux de recherche et les actions de rétablissement de l'espèce, nous avons fait une compilation et une évaluation des occurrences récentes et historiques de tortues luth dans les eaux de la Colombie-Britannique. Ce rapport porte sur 119 signalements de tortues luth enregistrés entre 1931 et 2009, et donne un aperçu des travaux de recherche effectués par Pêches et Océans Canada entre 2002 et 2008 concernant cette espèce dans les eaux pacifiques du Canada. L'information sur les occurrences signalées a été recueillie au moyen d'enquêtes, de questionnaires et d'une campagne de sensibilisation. En 2003, un questionnaire a été envoyé à environ 1 500 marins et pilotes de la côte pour savoir s'ils avaient déjà aperçu des tortues luth lors de leurs sorties en mer. Le suivi des occurrences de tortues luth s'est poursuivi entre 2002 et 2008, dans le cadre de 21 opérations de recensement de cétacés à bord de navires croisant sur la côte de la Colombie-Britannique, et de 4 opérations de recensement aériennes spéciales conduites entre 2005 et 2007. Les occurrences de tortues luth sont observées sur toute la côte pacifique du Canada, normalement entre la fin de l'été et le début de l'automne, avec une pointe durant le mois d'août.

1. INTRODUCTION

Leatherback sea turtles (*Dermochelys coriacea*) are listed as a Critically Endangered species by International Union for the Conservation of Nature and Natural Resources (IUCN) throughout their entire range (Sarti Martinez 2000) because of a striking decline in global populations, particularly in the Pacific Ocean, over the last generation (Pritchard 1982, Spotila et al. 1996, Spotila et al. 2000). In the Pacific, leatherback turtles comprise two distinct populations that nest in Mexico and Costa Rica (Eastern Pacific population) and in Papua (Indonesia), Papua New Guinea, Solomon Island and Vanuatu (Western Pacific population) (NMFS-USFWS 1998). Genetic and satellite telemetry studies indicate that leatherback turtles found off the west coast of North America belong to the western Pacific population (Dutton et al. 2000, Benson et al. 2007a). These turtles travel great distances between nesting and foraging habitats. Many have been tracked across the Pacific to the coast of North America where they forage for their primary prey, gelatinous zooplankton (Bleakney 1965, Eisenberg and Frazier 1983, Den Hartog and Van Nierop 1984). Although no tagged turtle has been tracked into British Columbia (BC) waters, a few have travelled to nearby Oregon and Washington (Benson et al. 2007a).

In conjunction with the enactment of the Species at Risk Act (SARA) in 2003, the Pacific leatherback turtle was officially listed as an endangered species in Canada. Although leatherback sea turtles can be considered a seasonal resident in Pacific Canadian waters, sightings are still considered uncommon (McAlpine et al. 2004, 2007), likely due to the species' wide distribution and low population size.

A *National Recovery Strategy* and an *Action Plan for the Leatherback Turtle (Dermochelys coriacea) in Pacific Canadian Waters* were drafted in 2003 (Recovery Strategy was finalized in 2006, Action Plan remains pending). Guided by objectives set out in these documents, Fisheries and Oceans Canada (DFO) initiated a research program in 2004 to determine the current status of leatherback turtles in waters off the Pacific coast of Canada. Basic information on the distribution and foraging habitats of this highly migratory species is critical to leatherback conservation and recovery research. The objectives are: 1) to compile and analyze historical and recent sightings; 2) to undertake surveys in leatherback habitat off the west coast of Canada to investigate patterns of seasonal occurrence and distribution and; 3) to determine the level of human-caused threats to leatherback turtles and their habitat in BC waters (PRTLT 2006).

There have been few published reports of leatherback turtles in BC waters (Kermode 1932, MacAskie and Forrester 1962, Stinson 1984, McAlpine et al. 2004) or in adjacent waters of Alaska (Hodge and Wing 2000), Washington (Eisenberg and Frazier 1983) or Oregon (Bowlby et al. 1994). A relatively recent update by McAlpine et al. (2004) includes 20 new reports of green and leatherback turtles in BC waters, and lists a total of 26 known leatherback sightings. These, in addition to sightings compiled by our study, have resulted in a total of 126 unique

leatherback sighting records in British Columbia. Here we summarize and describe these sightings with respect to their spatial and seasonal patterns of occurrence.

2. MATERIALS AND METHODS

Efforts to determine leatherback turtle occurrence in BC waters began in 2003 with an extensive search of published and unpublished literature, distribution of sightings questionnaire and the development of a sighting and incident reporting program. Research and outreach efforts continue to encourage reporting of sea turtle observations. Furthermore, dead and distressed sea turtle reports are tracked and responded to via DFO's Marine Mammal Response Program.

2.1. LITERATURE AND DATASET SEARCH

Sightings were compiled from historical newspapers, peer-reviewed publications and reports, and archival datasets held by other organizations. At-sea observer sighting data from commercial trawl, trap and longline fisheries (1991 to 2006) were reviewed for leatherback sightings. As well, by-catch data from salmon gillnet, seine and troll fisheries, and groundfish trawl fisheries (1996-2006) were queried for leatherback entanglements.

2.2. QUESTIONNAIRE

A questionnaire-style survey was conducted jointly in 2003 by DFO and the Sea Turtle Awareness Program (STAP), a program funded during 2002-04 by DFO's Habitat Stewardship Program (HSP) and undertaken by the Vancouver Aquarium. Since 2005, the STAP program has been amalgamated with the BC Cetacean Sightings Network (BCCSN). The questionnaire was designed to solicit voluntary reports of all sea turtle sightings in BC waters (Appendix A) both recent and historical.

Questionnaires were sent to active commercial fishing licence holders in the tuna and halibut hook and line, salmon troll and seine, groundfish trawl, and urchin and clam diving fisheries. Additional questionnaires were sent to various other mariners, coastal aviation pilots, recreational fishing operators and lodges, First Nation bands, ecotourism operators, Canadian Coast Guard fleet, marine researchers, ferry captains, boating organizations, and marina operators.

Respondents were asked to describe details of sea turtle sightings (e.g., location, date, species description, and were provided line drawings of leatherback and green sea turtles for reference), their experience and seasonality of their time at sea and, if involved in fishing activities, the species targeted and gear type used. Periodic reminders to fishermen were sent via DFO Fishery Notices requesting reports of sea turtle sightings, including incidents of by-catch.

2.3. SIGHTING REPORTS

In partnership with DFO, the BCCSN continues to collect and archive sightings through a toll-free hotline, e-mail, website and talks aimed at educating the public on sea turtles and cetaceans found in BC waters to encourage accurate species identification. These programs actively distribute sighting logbooks to interested boaters and coast watchers to promote voluntary reporting of cetacean and sea turtle observations. A number of marine mammal research, conservation and outreach organizations are members of the BCCSN and also contributed their sightings reports to this central sightings database. Report details typically include basic information pertaining to date, location, number and description of the animal(s). Additional information on weather, sea state and observational platform is requested via the online form but is often not provided.

2.4. INCIDENT TRACKING

As DFO is responsible for the recovery of leatherback turtles in Canadian waters under SARA, threats faced by leatherbacks in these waters must be identified and addressed. Therefore, incidents involving sick, injured, entangled or dead turtles are tracked by the DFO's Marine Mammal Response Program. In addition to maintaining the dataset, the program aims to provide assistance, rescue or post-mortem analysis in the event of a turtle in distress.

2.5. SURVEYS

British Columbia's complex coast includes thousands of islands and fjords, totalling over 27,000 km of shoreline. Aerial and vessel-based surveys for cetaceans and sea turtles were conducted using a variety of design methodologies to maximize coverage and sightability within budgetary constraints.

2.5.1. Aerial surveys

Aerial surveys were designed with the primary target of leatherback turtles in mind, while also documenting cetacean observations. Based on preliminary distribution and seasonality of leatherback sighting reports, surveys were flown over neritic waters (between shore and the 200 m isobath at the inner continental shelf edge) off the west coasts of the Queen Charlotte Islands and Vancouver Island. Three separate systematic stratified surveys were designed to maximize efficiency and surface area coverage while also considering the bathymetric features consistent with leatherback turtle presence in similar foraging habitats. Benson et al. (2003, 2007b) suggested that wind driven upwelling, coupled with steep slope areas and shelf breaks, create areas where nutrient-rich waters are retained. Conditions in these waters are favourable for potentially high densities of jellyfish and leatherback foraging opportunities. Survey methodology employed by Shoop and Kenney (1992), Bowlby et al. (1994), James (2000) and those currently conducted off California (Forney et al. 1991; Karin Forney, NOAA Fisheries SWFSC, Monterey, CA, pers. comm.; Scott Benson, NOAA Fisheries SWFSC, c/o Moss Landing Marine Lab, CA, pers. comm.; Erin LaCassella, NOAA Fisheries, SWFSC,

La Jolla, CA, pers. comm.) were also considered to ensure as much consistency as possible with similar survey efforts.

The Queen Charlotte Islands survey, conducted during 11-12 September 2005, consisted of 1032 km of pre-determined survey track (Figure 1a). A zigzag survey pattern was followed off the west coast of Graham Island, where the 200 m isobath is up to 30 km offshore. Off the west coast of Moresby Island, where the 200 m isobath is within 5 km of shore, the survey followed a shoreline contour pattern. On 1-2 August 2006, 5-6 September 2006, and 24-25 August 2007, surveys were undertaken off the west coast of Vancouver Island, with transect lines oriented east-west and spaced at 13 km intervals (Figure 1b), covering a total of 981 km of survey track. Due to the coast-wide extent, aerial survey distance was calculated using GIS in BC Albers Conic Equal Area projection.

The aerial surveys were conducted in a Cessna 185 float plane with one pilot and two observers (the first half of the first survey only had 1 observer) at an altitude of 200 m and airspeed of 185 km hr^{-1}. Although the Cessna 185 is not an ideal aircraft for such surveys, an aircraft equipped with pontoon floats was warranted due to the remoteness of the waters being surveyed. Observers were positioned in the front-right and rear-left seats of the aircraft. Bubble windows were only available for the pilot and front-right observer. The suite of surveys involved 4 separate observers and 2 pilots; one of the observers was involved in 3 of the 4 surveys. All but one of the observers was experienced in aerial detection of marine mammals and familiar with protocols.

Sighting effort was limited to visual flight rule (VFR) conditions and to a maximum of Beaufort Sea State 4. High overcast cloud cover created the most favourable lighting conditions due to reduced sun glare. Effort was suspended at any time during a transect leg when conditions such as rain or fog obscured visibility. When conditions improved, observer effort resumed. Aerial survey routes were designed using navigation software (Nobeltec Visual Navigation Suite™, Nobeltec Corporation) and positions were entered into an on-board GPS system for navigation and tracking of the flight path. Survey legs were no more than 4.5 hours in length, in consideration of aircraft range and observer fatigue.

Data collected included a continuous GPS track, captured every 15 seconds, and periodic recordings of the time, latitude and longitude, and survey conditions (Beaufort sea state, precipitation, percent cloud cover and angle of glare), as conditions and effort changed. Data collected for each sighting included species (and reliability of the identification), the number of animals per species identified, the altitude, time and coordinates of the plane when the target animal was abeam the plane, as well as the declination angle to the target animal using a Suunto™ clinometer. When sightings were made, and once initial data were recorded by the opposite observer, the plane typically circled the area to confirm species identification and obtain further details before resuming the transect route.

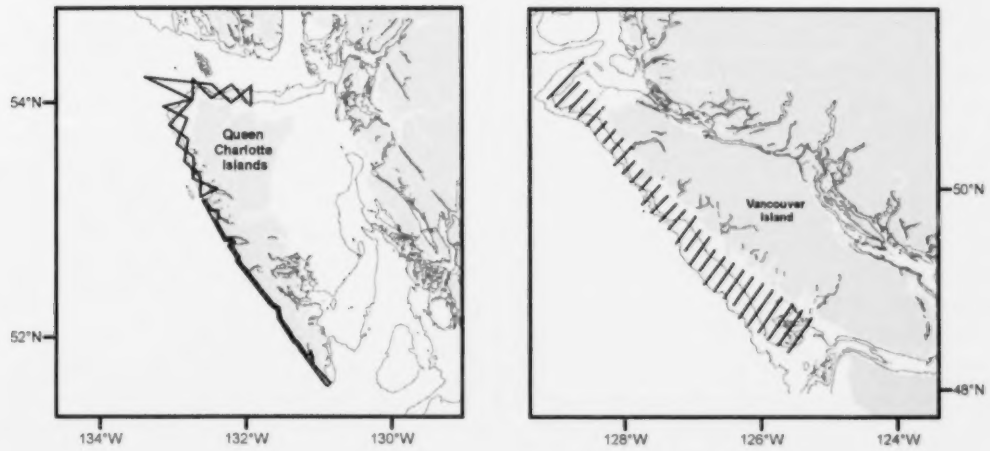

Figure 1. Planned aerial survey routes off (a) the west coast of the Queen Charlotte Islands and (b) the west coast of Vancouver Island, 2005-2007.

2.5.2. Shipboard surveys

Between 2002 and 2008, 21 dedicated shipboard surveys of 6 to 23 days duration were conducted off the coast of BC. The surveys were designed for cetacean research, but leatherback turtles were also included as a target species of interest. Surveys were conducted on board Canadian Coast Guard vessels and one contracted vessel, with 2 dedicated marine mammal observers and a data recorder on duty at any given time. Observers rotated positions every 30-60 minutes and were on duty for a total of 1.5-3 hours before receiving a break of at least the same timeframe. They scanned the waters ahead of the ship from -10° to 90° and 10° to -90° from the bow. Scans were designed to include all waters between the ship and the horizon, and were undertaken using Fujinon™ 7x50 or 25x150 MTM heavy duty military binoculars ('Big Eyes') with reticles that were pedestal-mounted on the vessel's observation deck. Observation effort was suspended in sea conditions greater than Beaufort Sea State 5, or in fog, heavy rain or dark conditions that reduced visibility to < 3 nm (Ford et al., in prep).

The ship's position, speed and weather conditions were collected at regular intervals using the ship's onboard GPS and Navigational instrumentation. Data collected for each sighting were recorded at the first sighting of the animal(s). Data included the species, the number of animals, time and coordinates of the vessel, reticle and angle reading from the bow to the target animal.

Survey distances were calculated using GIS in BC Albers Conic Equal Area projection due to the coast-wide scale of survey coverage. Further details about the results of the ship-based surveys and their methodology are described in Ford et al. (in prep).

3. RESULTS

3.1. OPPORTUNISITIC DATA

3.1.1. Literature and Dataset Search

In total, 29 leatherback turtle sightings were collected from published sources (Kermode 1932, MacAskie and Forrester 1962, Carl 1963, Stinson 1984, Hodge and Wing 2000, McAlpine et al. 2004) including a report of the first sighting of a leatherback turtle in BC waters in 1931 near Nootka Sound, off the west coast of Vancouver Island. An additional 6 sightings were acquired from datasets of various species sightings held by The Wild Bird Trust and the Royal British Columbia Museum's archives. No sightings were found in fishery observer or by-catch datasets.

3.1.2. Questionnaire

The questionnaire, designed to solicit sightings of any sea turtle species, was sent to 928 commercial fishermen (mainly salmon gillnet and troll licence holders) and to 550 other mariners. Of these, 201 questionnaires (13.5%) were completed and returned. The returned questionnaires reported 63 sea turtle sightings in BC waters: 34 (54%) leatherbacks; 14 (22%) green turtles; and 15 (24%) unknown sea turtle species.

A total of 32 newly described leatherback sighting reports were received from questionnaires. Most came from commercial fishermen (78%) with an additional 3 (9%) from recreational fishing guides, 3 (9%) from ecotourism operators, and 1 (3%) from a coastal pilot.

3.1.3. Sightings Reports

A further 70 leatherback turtle and 21 unidentified sea turtle sightings were reported to DFO, STAP or BCCSN during 2003-2009 as a result of awareness campaigns and outreach efforts. Most reporters were interviewed to confirm species identification and to obtain as many relevant details as possible.

3.2. SURVEY DATA

3.2.1. Aerial surveys

Despite approximately 32 hours of active searching covering 3790 km during three summer seasons (Figure 2a, b, c, d), no sea turtles were sighted during aerial surveys.

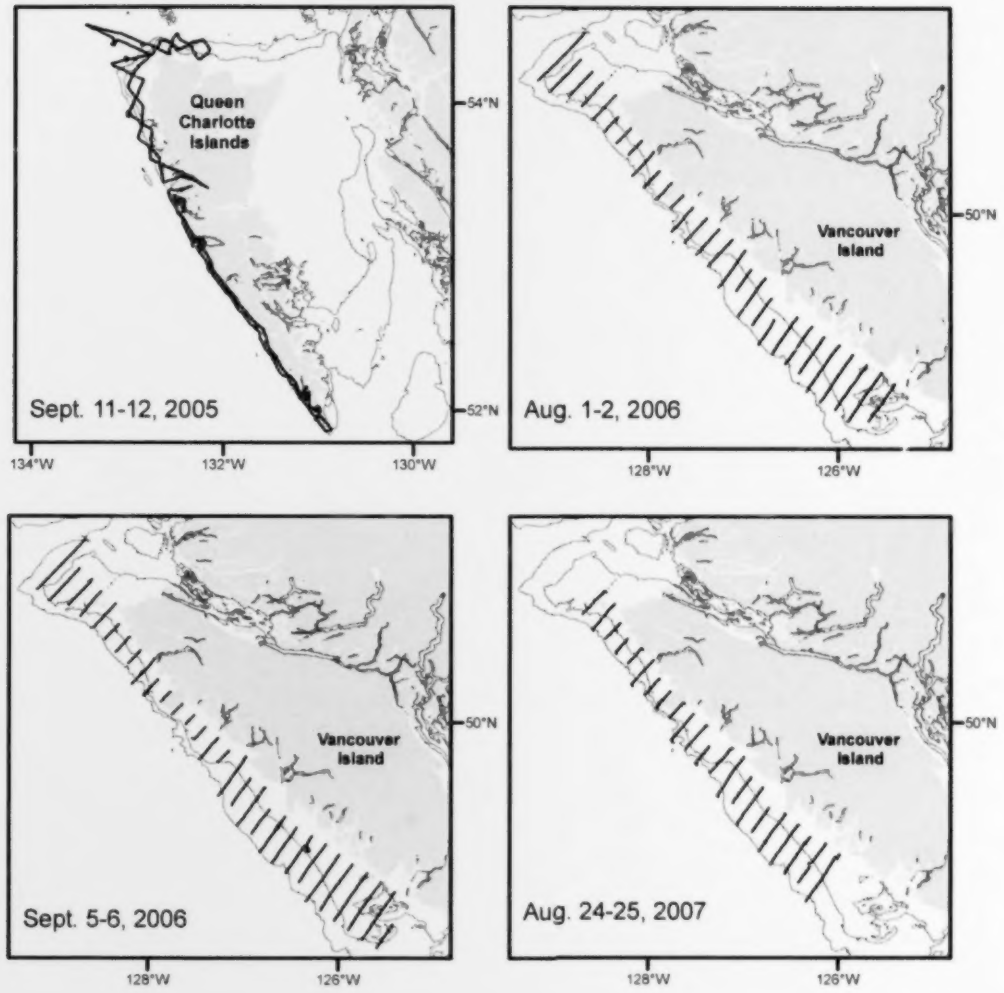

Figure 2. Aerial survey tracks for (a) September 2005, (b) August 2006, (c) September 2006, and (d) September 2007. Also shown are the 100 and 200 m isobath.

3.2.2. Shipboard surveys

In total, 29,165 km of survey track was surveyed over 1,808 hours of effort (Figure 3). During shipboard cetacean surveys, three leatherbacks were sighted while off southern Queen Charlotte Islands (QCI) in August of 2003, 2005 and 2007: 8 km east of Skincuttle Inlet (SE QCI) in 2003; 14 km outside Houston Stewart Channel (SW QCI) in 2005; and 56 km SSW of Cape St. James (S tip of QCI). The 2005 animal was approximately 1.5 m in length and occurred in waters over 700 m deep. It was not observed feeding; however Lion's mane jellyfish (*Cyanea capilatta*) were seen in the area during the hours surrounding the sighting. The 2007 turtle was found in the vicinity of the deep ocean "gullies" between the Queen Charlotte Islands and Vancouver Island in approximately 2500 m of water. Survey

and logistical constraints prevented any detailed observations of the turtles to study swimming and feeding behaviour, nor were any attempts made to capture the turtles for tagging or genetic sampling. The 2005 and 2007 sightings occurred off transect while approaching a whale of interest.

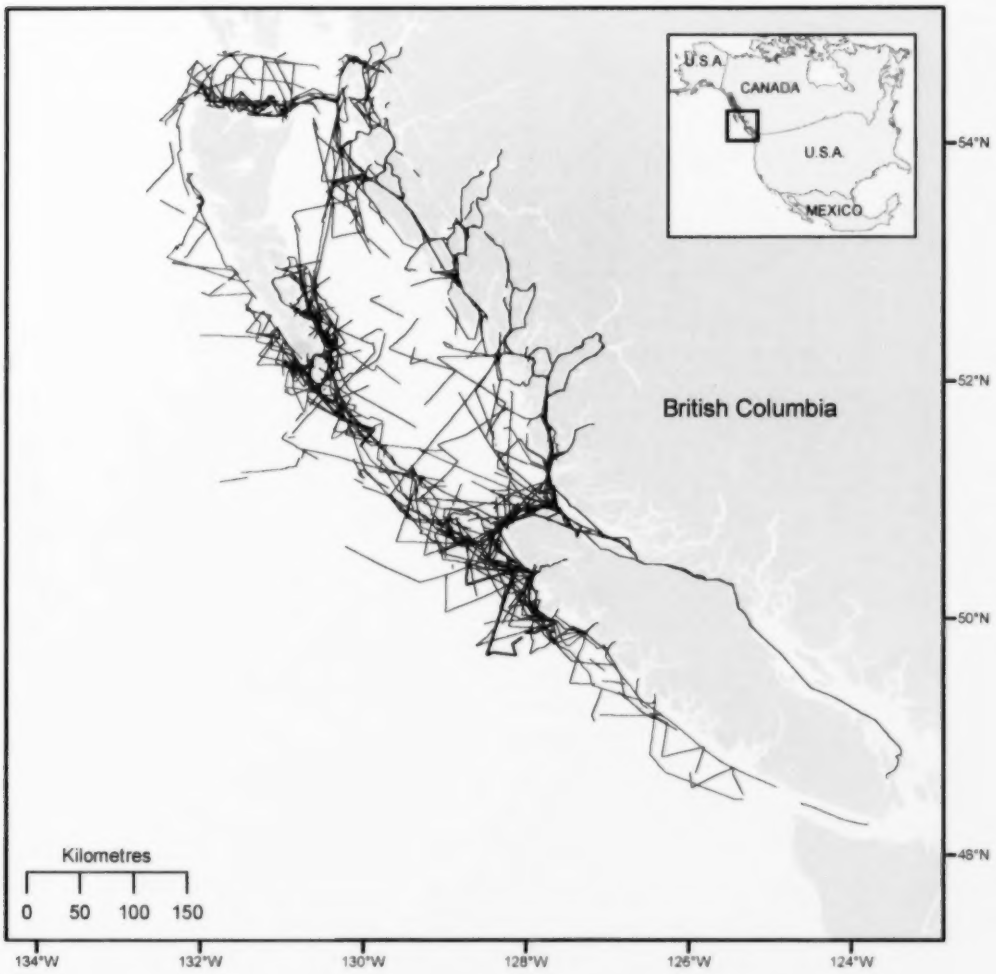

Figure 3. On-effort track lines from survey cruises, 2002-2008.

3.3. COMBINED DATA ANALYSIS

The combined leatherback and unknown sea turtle sighting dataset from all sources (n = 168) assumes that sightings are independent of one another and are of leatherback turtles. Of these sightings, 3 remain unconfirmed reports and were therefore eliminated. Also eliminated were 36 records where the animal description did not indicate positive or highly probable leatherback identification based on carapace shape and colour, the animal's size and overall behaviour. Furthermore, 10 records were excluded to avoid any duplicate reports; no two

sightings within 24 hours of each other within a 5 km radius were included in the data analysis, unless they were made by the same observer moving along an unchanged heading. The corrected dataset therefore includes 119 unique leatherback sighting events (Appendix B). These events include a total of 126 leatherback turtles, as all except 3 sightings were judged to be of a single leatherback turtle. Records of the 36 unidentified sea turtles sightings are included in Appendix C.

3.3.1. Seasonality and distribution

From the corrected dataset, 112 reports included the year of the sighting; 10 of which were estimated from a range of possible years. Leatherback turtles have been seen in BC waters in 39 of the 79 years since the first sighting in 1931. The great majority of sightings have occurred in the past 3 decades (Figure 4).

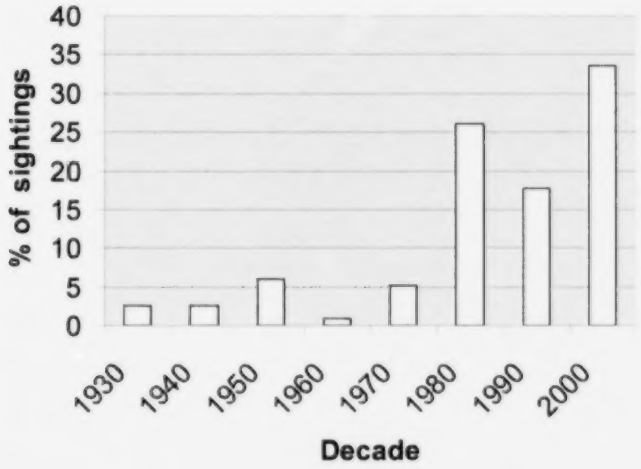

Figure 4. Decadal distribution of leatherback turtle sightings from 1931 to 2009 (n = 112 that include year data) in BC waters.

The corrected database includes 99 records describing the month of the sighting; 5 of which were estimated based on a seasonal description. Although leatherback sightings have been reported in all months except January and December (Figure 5), there is evidence of a seasonal peak in sightings during late summer to early fall. There was a marked increase in reports in June, becoming most common in August. July through September accounted for 81% of sightings: 19 in July; 34 in August; and 27 in September.

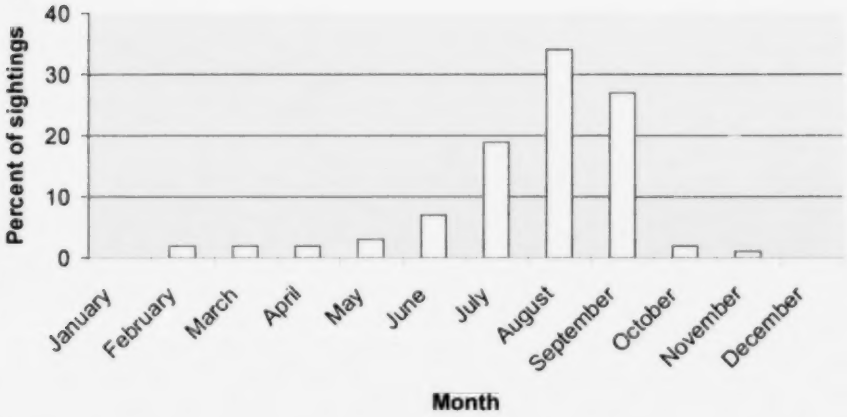

Figure 5. Monthly distribution of leatherback turtle sightings from 1931 to 2009 (n = 99 that include month data) in BC waters.

Coordinates were estimated for records where only a general descriptive location was available, resulting in a total of 118 geo-referenced sightings (Figure 6). Of these, 65% of sightings were made in southern BC waters off Vancouver Island, 27% off the north coast and Queen Charlotte Islands, and 8% off the central coast. Although leatherback turtles have been reported in most areas of the BC coast, 71% of sightings were located off the western-most coasts. A cluster of sightings over La Perouse Bank, off southwest Vancouver Island, stands out graphically as an area of historical high-use, however only 2 sightings have occurred there in the last decade. Since 2000, sightings remain most numerous in waters greater than 55 km offshore (37%) followed by the near-shore waters off SW Vancouver Island (17%).

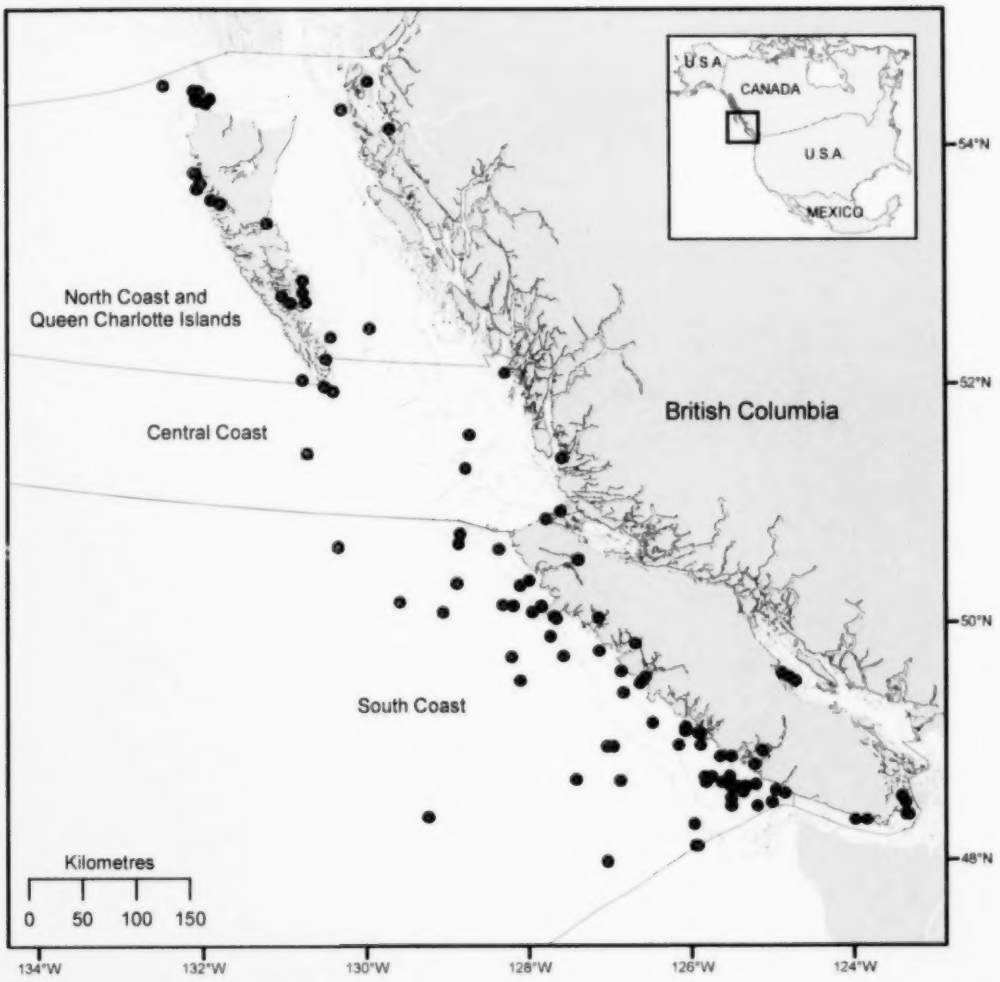

Figure 6. Location of leatherback sightings (n = 118) in British Columbia. Also shown are geographic sub-regions referred to in Table 1 and 2, as well as 100 m and 200 m isobath.

To further illustrate sighting distribution of live leatherback turtles, depth was obtained for 80 records with exact coordinates or estimates from an approximate distance and direction from a point of land. Of those, 71% occurred in neritic waters on the continental shelf (<200 m depth), while 18% were found over the continental slope (200-2000 m depth) and 9% were encountered further offshore (>2000m).

In combining the temporal and spatial data, no patterns of leatherback movement in BC waters were able to be identified. Sightings are highest in all areas of the coast during the summer season (Table 1), but intra-seasonally there was no directional succession of sightings as summer progressed. Therefore, leatherback turtles do not appear to utilize specific areas of BC at different times of the year,

but rather are found widely scattered throughout the full extent of the coast mainly during summer months.

Table 1. Leatherback turtle sightings reported in BC by season and region.

	South Coast	Central Coast	North Coast & QCI	**Seasonal Total**
Winter (Jan - Mar)	3	0	1	**4**
Spring (Apr - Jun)	11	0	1	**12**
Summer (Jul - Sep)	50	9	21	**80**
Fall (Oct - Dec)	2	0	1	**3**
Unknown month	11	0	8	**19**
Regional total	**77**	**9**	**32**	**118**

3.3.2. Event types

The dataset reveals limited information on threats to leatherback turtles in Pacific Canadian waters (Table 2) as the majority (81%) of the unique sighting records involved turtles reported alive and behaving normally. There were 14 turtles reported dead and cause of death remains inconclusive in over half those cases. Only 1 necropsy was performed on a leatherback turtle, by a local biology class at Kyuquot. The tissue samples and field notes from that effort have not been located. No dead or distressed leatherback turtles have been reported to the DFO Marine Mammal Response Program since 2004.

Human interactions account for 12% of the unique records: 3 turtles were shot dead; 1 was struck by a small recreational vessel and survived; 10 were found entangled in fishing gear. Of these entanglements, 7 turtles were successfully released alive.

Table 2. Sea turtle sightings reported in BC by sub-region and event type.

Location	**Sighting** *alive*	**Dead** *cause unknown*	**Entangled** *released alive*	**Entangled** *dead*	**Shot** *dead*	**Ship strike** *alive*	**Regional total**
South Coast	64	5	3	1	3	1	**77**
Central Coast	9	0	0	0	0	0	**9**
North Coast, QCI	23	3	4	2	0	0	**32**
Unknown location	1						**1**
Event total	**97**	**8**	**7**	**3**	**3**	**1**	**119**

Entanglement in gillnets comprised 60% of the entanglement reports, followed by 20% in seine nets and single cases of entanglement in a troll stabilizer line and unidentified line (likely the floatline from a trap or dermersal longline). All entanglements occurred in July, August or September, and were widely distributed throughout BC waters.

4. DISCUSSION

4.1. SPATIAL AND TEMPORAL DISTRIBUTION OF SIGHTINGS

As the majority of these data are derived from voluntary reporting of sightings, mainly from near-shore waters, they are likely an underrepresentation of possible leatherback turtle abundance in BC waters. However, given that only three leatherbacks were sighted despite 2040 hours of shipboard and aerial survey effort over 5 years, it is apparent that leatherback turtles remain relatively infrequent visitors to Pacific Canadian waters.

Patterns of seasonal leatherback turtle occurrence, presented here, are consistent with those previously reported off BC (MacAskie and Forrester 1962), off Washington and Oregon (Bowlby et al. 1994) and off central California (Benson et al. 2003, Benson et al. 2007b). These data also support findings that leatherback turtles regularly occur in cold temperate waters of high latitudes (Bleakney 1965, Goff and Lien 1988, Eckert et al. 1989), and that the leatherback turtle "season" appears to take place from July through September off the west coast of North America (Stinson 1984, Starbird et al. 1993, Bowlby et al. 1994, Hodge and Wing 2000).

Leatherback seasonality and distribution in high latitudes have been linked to warm sea temperatures and areas of upwelling. Sea surface temperatures in BC peak in late August at 18-20°C (Thomson 1981), consistent with the observations that leatherbacks most commonly occur in north-eastern Pacific waters in summer and early fall when sea surface temperatures (SST) are highest (Bowlby et al. 1994). Observations of leatherbacks tend to correspond with the 16°C isotherm both along the west coast of North America (Stinson 1984) and in Atlantic Canada (James et al. 2006), although turtles may be found in waters ranging from 3° to 20°C. This isotherm remains offshore most of the year, then moves inshore in early spring and summer (off California) and northward toward the BC coastline in July and August (Stinson 1984), suggesting that leatherbacks may migrate northward along with this isotherm up the coast of North America as summer progresses. However, no significant north-south trend in sighting distribution can be discerned from these data, suggesting that turtles may arrive in BC from offshore waters.

Other physical and biological oceanographic processes have also been proposed to explain variances in leatherback distribution. James et al. (2005b) and Benson et al. (2007) have linked leatherback turtle presence with oceanic thermal fronts, current fronts, vertical gradients, upwelling relaxation or retention. These processes are indicative of areas of high productivity and are therefore mechanisms for prey production, growth or entrainment. BC waters are characterized as a transitional area between strong seasonal coastal upwelling (California Current) and downwelling (Alaskan coast) regimes, allowing for high climate and ocean variability (GLOBEC 1993). Furthermore, the BC coast also features numerous deep canyons and gullies. Those that intersect the continental

margin may upwell nutrient-rich waters onto the continental shelf (GLOBEC 1993) where hydromedusae are in abundance throughout the summer months (Mackas 1992), making neritic waters of coastal BC waters favourable habitat for leatherbacks turtles.

4.2. LIMITATIONS

4.2.1. Aerial Observer Effort

Where possible, efforts were made to remain consistent with aerial survey methods used by other leatherback research efforts. As such, the survey speed and altitude were selected to maximize the sightability of leatherback turtles based on their size at the surface.

In ideal conditions, the probability of sighting a turtle at the surface in aerial line transect models is assumed to be 100% at the transect line. However, this probability is reduced by the proportion of time a turtle spends below the surface, out of sight by the survey observers. Benson et al. (2007b) assessed this availability bias of leatherback turtles using dive data along with a calibration to determine the visible depth range of observers. Provisionally, leatherbacks were found to spend an estimated 47% of their time at or above the 1 m depth detectable by aerial observers. Sighting ability may also be influenced by environmental conditions at the time of the sighting. Benson et al. (2007), however, determined that Beaufort Sea States 0-3 did not affect encounter rates, nor did cloud cover or sun glare have a significant effect on aerial survey observations.

As no leatherback turtles were seen throughout these surveys, we must also acknowledge that the presence of pontoons below the aircraft and the lack of bubble windows for some observers likely decreased the probability of sighting a turtle. Moreover, as survey conditions in this study were kept within Beaufort levels 0-4, one level higher than assessed by Benson et al. (2007b), these may have introduce some viewing limitations.

4.2.2. Ship-based Observer Effort

Ship-based surveys were designed to maximize cetacean observations along a designated track line and observers were trained to scan thoroughly from the horizon to the ship in a 90° area on either side of the bow, mainly using binoculars or Big Eyes. However, as cetaceans are detected by viewing their large bodies, splashing and vertical blows above the surface, they are more easily detected from a distance than a low-profile, relatively slow moving sea turtle. Leatherbacks are more likely to be seen when looking down with bare eyes into nearby water rather than towards the horizon. This difference in detectability may account for the relatively few leatherback turtle sightings acquired from vessel-based surveys.

4.2.3. Opportunistic Reports

Opportunistic sighting data present intrinsic limitations in that each sighting may not represent a new animal, as no measure of effort is available. Sightings made within the same general area and same day were considered duplicates and

removed. However, as turtles and boaters move about, repeat sightings are possible. Furthermore, an observer's recollection of the exact date and location of a sighting is also not without fault. Therefore, we cannot conclusively state that all duplicate sightings of a single turtles' travels within BC in a given year were removed from the dataset.

Sightings were notably skewed with more numerous reports in recent decades and even more so over the past 5 years. This increase is likely a representation of focused outreach efforts rather than suggesting an increase in leatherback occurrence in BC waters. It may also reflect the relative age of the observer questioned, and the quality of observer memory. Observers are more likely to remember specific details related to location and an animal's appearance, if the sighting occurred in more recent years, thus providing more reliable data and species confirmation.

Many sighting reports were geo-referenced using estimated coordinates based on location descriptions from observers, so some measure of error is to be expected. Nevertheless, the majority of leatherback sightings occurred on the continental shelf, and sightings were noticeably higher during fishing and boating seasons throughout summer and early fall months. As British Columbia has the largest continental shelf in the northeastern Pacific south of the Bering Sea (GLOBEC 1993), it supports extensive fishing effort and boating activities. It is therefore realistic to expect that seasonal changes in boater distribution and density would have a prominent influence on both the spatial and temporal aspects of reported leatherback sightings. Boaters in near-shore waters may also be more likely to report sightings than those operating large freighters offshore, for instance, due to communication logistics and lack of awareness of reporting sea turtle research and conservation efforts in BC waters.

4.3. THREATS TO LEATHERBACK TURTLES

The occurrence of leatherback turtles along the coast of North America coincides, to a large degree, with the summer boating season and an increase in fishing effort. Thus, threats from entanglement and incidental take in fishing gear, ship strikes, and ingestion or entanglement in marine debris have been identified in both the US and Canadian Recovery Strategies/Plans for Pacific waters (NMFS and USFWS 1998, PLTRT 2006, NMFS and USFWS 2007).

Only one necropsy has been performed on a stranded leatherback found in BC to date. Results of that examination were inconclusive and cause of death could not be determined. No other fresh carcasses have been reported and subsequently retrieved.

Elsewhere, leatherbacks are particularly susceptible to incidental capture or entanglement in pelagic longlines, trawls, gillnets (including driftnets), pots, traps and pound nets (NMFS-SEFSC 2001, Carretta et al. 2005). Accidental catch in gillnets and pelagic longlines has been implicated in the decline of leatherbacks in

the North Pacific (Spotilla 2000, Lewison 2004). In the temperate coastal foraging habitats of Canadian waters, gillnets, and vertical lines from buoys and mooring lines, especially slack or floating ones, are the primary reported cause of entanglement (James 2005a, McAlpine et al. 2007). From limited entanglement reports, this appears to be consistent in BC waters. However, there are no pelagic longline fisheries in Pacific Canada. Demersal longlines, such as those used in BC halibut and sablefish fisheries, have not been implicated as a threat to leatherbacks. Gillnet fisheries for herring roe operate in March and April, while salmon fisheries are in operation off the BC coast from March through October, therefore coinciding with leatherback turtle presence in these waters.

Although mortality due to ship strikes has been identified as a potential threat to leatherbacks throughout the world, there is little evidence suggesting collision events pose more than a minimal risk (TEWG 2007). There is only one record of a ship strike reported in BC, between a leatherback and a slow-moving small recreational fishing vessel. Damage to the turtle and boat were considered negligible. It is unknown if collisions between leatherbacks and large ships take place in BC waters, as operators of large vessels are not likely to feel the impact of a collision with a sea turtle.

As so few human interaction-related records have been reported, it is not possible to draw meaningful conclusions regarding the gear type that represents the largest entanglement threat, nor as to the seasonality or distribution of other threats in Pacific Canadian waters. Further details on the potential threats to Pacific Canadian leatherback turtles in BC waters are provided in the Recovery Strategy (PLTRT 2006).

5. CONCLUSIONS AND RECOMMENDATIONS

In order to achieve Pacific leatherback turtle recovery goals set out in both the US and Canadian Recovery Strategies, numerous knowledge gaps require more focused research. In BC waters, where leatherback sightings are infrequent, continued support of both the BC Cetacean Sightings Network's and BC Marine Mammal Response Network's efforts to solicit reports of these sightings and provide public awareness of leatherback occurrence in local waters remains a priority. Turtles should continue to be a focal species in marine mammal shipboard and aerial survey efforts throughout the coast, and partnerships with other agencies conducting similar studies should be explored to expand observational efforts.

Leatherback habitat preferences in BC waters remain poorly understood. As prey is a significant driving force in leatherback migration, studies characterizing prey distribution and concentration mechanisms are of significant value. Assessing the influence of sea surface temperatures and oceanographic phenomena, such as upwelling, retention and relaxation, on gelatinous zooplankton will improve our

understanding of habitat use in BC waters, help to identify critical habitat for this species, and mitigate potential threats to the habitat and turtles themselves.

Although many questions remain unanswered about leatherback turtle abundance and their use of Pacific Canadian waters, we now know that their presence in BC is more frequent than was previously known. We can also presume that the number of turtle sightings presented here is a minimal representation of the actual number of turtles occurring off the coast. Continued awareness and survey observations for leatherbacks in years to come will help to clarify their abundance.

Regardless of how important BC waters are to leatherback turtles, DFO has a jurisdictional responsibility to protect this endangered species from any threats they may face while in Pacific Canada. Research aimed at further characterization of their foraging habitat will be critical to ensuring adequate protection.

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APPENDIX A - Questionnaire

BC SEA TURTLE QUESTIONNAIRE

Please check the appropriate answer boxes and fill in the blanks with as much detail as possible. Feel free to attach more information on extra pages.

SEA TURTLE SIGHTINGS:

1) Have you ever seen a sea turtle in BC waters?
☐ YES ☐ NO

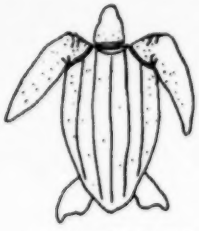
IF ANSWERED "NO" TO BOTH 1 & 2 SKIP TO 7 ON OTHER SIDE

2) Do you know of anyone else who has seen a sea turtle(s) in BC waters?
☐ YES ☐ NO

Please provide name(s) and contact number(s), if possible.
Name Contact Information

3) Please indicate, as best you can, when and where you (or a friend) have encountered a sea turtle(s) and give a description of the animal(s).

Year & month	General location	Latitude/Longitude	Description of turtle (colour, size, shape, etc.) Indicate if it looked like either of the drawings below.



LEATHERBACK TURTLE

GREEN TURTLE

4) In any of your encounters, did the turtle(s) appear to be feeding?
☐ YES ☐ NO

What were the turtle(s) feeding on?

5) Do you have photographic or video evidence of your encounter(s)?
☐ YES ☐ NO

Please indicate if you are willing to share them with us
☐ YES ☐ NO

Fisheries and Oceans Canada Pêches et Océans Canada Canada VANCOUVER AQUARIUM MARINE SCIENCE CENTRE

BC SEA TURTLE QUESTIONNAIRE

6) Did you observe any other unusual animal species in the vicinity of your turtle sightings?
☐ Sunfish ☐ Shark ☐ Other:_____

PERSONAL BACKGROUND:
This information is used to gauge which areas and times of the year turtles are, or are not, found.

7) What fisheries category(ies) apply to you?
☐ Gillnet
☐ Troll
☐ Longline
☐ Seine
☐ Trawl
☐ Traps
☐ Dive
☐ Aquaculture
☐ Other: _____

8) What species do you target?
_____
_____

9) How many years have you been operating off the BC coast?
☐ 1 to 5 years
☐ 6 to 10 years
☐ 11 to 20 years
☐ over 20 years

10) What season(s) are you on the water?
☐ Spring
☐ Summer
☐ Fall
☐ Winter

11) Please describe the area(s) in which you normally operate (include Fishing Areas, if possible):
_____
_____

We would appreciate if you could provide us with your contact information below. All personal information is protected under the Privacy Act.

☐ **I acknowledge that my contact information will be stored by the Vancouver Aquarium and the Department of Fisheries and Oceans Canada, and will ONLY be used for the purposes of confirming this report. My personal information will not be distributed or displayed without my consent and I have a right to access this information at any time.**

Name _____
Company _____
Address _____
City _____ Postal Code _____
Phone # (_____)_____ Email _____

12) Before receiving this package, did you know sea turtles can be found in BC waters?
☐ YES ☐ NO

13) Would you be interested in receiving updates on our sea turtle research and stewardship efforts?
☐ YES ☐ NO

To learn more about leatherback turtles in BC, please visit:
- DFO Recovery Strategy and Action Plan: http://www-comm.pac.dfo-mpo.gc.ca/pages/consultations/leatherback-turtles/default_e.htm
- Vancouver Aquarium Marine Science Centre: www.vanaqua.org/sightings

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APPENDIX B - Unique leatherback turtle sightings

Event Type	Animal Status	# Turtles	ID Confidence	Year	Month	Day	Sighting Location	Latitude	Longitude	Size Description	Physical Description	Behaviour	Source
Shooting	Dead	1	certain	1931	8	16	Nootka Is., 8 mi. S of Bajo Rf.	49° 27'N	126° 53'W	Anon 1931a reports: 1400 lbs., 9.5 ft. long, 10 ft. wide, 1.5 ft. thick. Anon 1931b reports: 1450 lbs., 12 ft. long, carapace 7 ft. long. Unsure which is correct.		laying on surface when first seen	RBCM# 460. Anon 1931a; Anon 1931b; Kermode 1932; Carl 1944; MacAskie and Forrester 1962; Stinson 1984
Shooting	Dead	1	certain	1931	8	30	Nootka Is., 8 mi. S of Bajo Rf.	49° 27'N	126° 53'W	Weight: 1450 lbs; similar in size and weight to first 1931 turtle.			Kermode 1932; Carl 1944; MacAskie and Forrester 1962; Stinson 1984
Shooting	Dead	1	certain	1934			Nootka Is.	49° 38'N	126° 55'W	Weight: 1200 lbs; total length: 8 ft. 6 in.; carapace length: 4.5 ft.; width: 10 ft. 6 in. with flippers spread;			Possibly same turtle as first 1931 animal, although size details differ. Picture at BC Archives, Victoria. Scans of orignal photos also provided by Lanny Seaton. Nicholson 1963.
Sighting	Alive	1	certain	1947	3	14	Denman Is., near	49° 35'N	124° 45'W	Carapace length: ~4 ft.		Free swimming	WBT Wildlife Data Centre; Carl 1947
Sighting	Alive	1	certain	1947	3	28	Denman Is.	49° 35'N	124° 45'W	Carapace length:4 ft.		Free swimming	Carl 1947; Anon 1947; Carl 1960; Stinson 1984
Sighting	Alive	1	certain	1947	9	16	Victoria, 200 yds. off Sayward Beach, Cordova Bay	48° 33'N	123° 21'W	Carapace length: 4 ft.		Free swimming	Carl 1960; Stinson 1984
Sighting	Alive	1	certain	1954	9	20	La Perouse Bk.	48° 42'N	125° 37'W				MacAskie and Forrester 1962; Stinson 1984
Sighting	Alive	1	certain	1954	9	21	Pachena Pt., 2 mi. W of	48° 41'N	125° 11'W		Large	Free swimming	Anon 1954a; Anon 1954b; MacAskie and Forrester 1962; Stinson 1984
Sighting	Alive	1	certain	1954	9	21	Esperanza In.	49° 48'N	127° 12'W			Free swimming	MacAskie and Forrester 1962; Stinson 1984
Sighting	Alive	2	certain	1954	9	23	Brooks Pen., at Brooks Bay	50° 10'N	127° 58'W			Free swimming	MacAskie and Forrester 1962; Stinson 1984
Entanglement	Dead	1	certain	1957	7	14	Barkley Snd., Useless In.	48° 58'N	125° 6'W	Weight: 653 lbs.; length: 71 in. ; width: 34 in.		Despite efforts to keep turtle alive after releasing from net, turtle died of exhaustion.	Anon 1957a; Anon 1957b; Anon 1957c; Carl 1960; MacAskie and Forrester 1962; Stinson 1984
Sighting	Alive	1	certain	1958	8		Goose Bk., Queen Charlotte Snd.	51° 35'N	129° 0'W	Length: 8 ft.		Feeding on fish guts from troller off stern of boat.	questionnaire
Sighting	Alive	1	certain	1959	11	1	Victoria - off McNeill Bay, near Trial Is.	48° 24'N	123° 18'W	Length: 8 ft.; width: 5 ft.		Free swimming with current. Dove as vessel approached and resurface 1000 ft away. Became very active, moving head and flippers and disappeared in rip tide off Trial Is..	Anon 1959a; Anon 1959b; Carl 1960; Carl 1963; Stinson 1964
Entanglement	Dead	1	certain	1961	9	23	Queen Charlotte Is., SE at Sedgwick Bay	52° 36'N	131° 32'W		Large		MacAskie and Forrester 1962; Stinson 1984
Sighting	Alive	1	certain	1970	7		Rivers In., Sharbau Is.	51° 25'N	127° 45'W				Stinson 1984; McAlpine et al. 2004
Sighting	Alive	1	certain	1972			Cape Cook, S of	49° 55'N	127° 50'W				questionnaire
Sighting	Alive	1	certain	1975	8		Barkley Canyon	48° 21'N	125° 58'W		"Spiny shell"		questionnaire
Sighting	Alive	1	certain	1976	8		Ucluelet, 24 mi. S of	48° 30'N	125° 30'W	Length: 7-9 ft.	Very dark colour, "spiny" shell		questionnaire
Sighting	Alive	1	probable	1977	7		Swiftsure Bk.	48° 32'N	124° 59'W		Very large		hotline/outreach
Sighting	Alive	1	certain	1977	9	14	Ucluth Pen., between Big Bk. and Ucluelet	48° 55'N	125° 38'W			Free swimming	RBCM #695; Stinson 1984; McAlpine et al. 2004

APPENDIX B - Unique leatherback turtle sightings

Event Type	Animal Status	# Turtles	ID Confidence	Year	Month	Day	Sighting Location	Latitude	Longitude	Size Description	Physical Description	Behaviour	Source
Sighting	Alive	1	certain	1980	6		Ucluelet, 5 mi. W of Amphitrite Lightstation	48° 55'N	125° 30'W				questionnaire
Sighting	Alive	1	probable	1980	8		Cape Mark, close to beach	52° 7'N	128° 33'W			Turtle came up under the seine net (close to beach) and sliced through the net	hotline/outreach
Sighting	Alive	1	certain	1980	8		La Perouse Bk.	48° 45'N	125° 50'W		Big and dark, resembled a leatherback.		questionnaire
Sighting	Alive	1	probable	1980	9		La Perouse Bk., at bottom of Big Bk., 8 mi. from US border, 14-15 mi. straight out from Cape Beale	48° 34'N	125° 30'W	Width: 3 ft.	Appeared to have barnacles on head	Swimming and diving	hotline/outreach
Sighting	Alive	1	certain	1980			Cape Cook , S of	49° 55'N	127° 50'W				questionnaire
Sighting	Alive	1	certain	1981	8	30	Skidegate In.	53° 15'N	131° 57'W				RBCM # 749; McAlpine et al. 2004; hotline/outreach
Entanglement	Alive	1	certain	1981	8	30	Skidegate In., off image Pt.	53° 15'N	131° 57.5'W	Weight: 800 lbs.; length: >6 ft.	"Sesame" shaped carapace (fine point at back and broad in front); head bigger than soccer ball, all black/dark colouring with light grey spots.	Swam into salmon gillnet. Struggled as it was being hoisted onto boat.	RBCM # 749; McAlpine et al. 2004; questionnaire; hotline/outreach
Sighting	Alive	1	certain	1981	9		Dundas Is., Chatham Snd.	54° 30'N	130° 40.2'W				Hodge and Wing 2000.
Sighting	Alive	1	certain	1981	9		Esperanza In., 15 mi. SW	49° 45'N	127° 40'W				questionnaire
Sighting	Alive	1	certain	1982	9	16	Esperanza In.	49° 52'N	126° 44'W				RBCM# 826; McAlpine et al. 2004.
Sighting	Alive	1	certain	1983	7	17	Graham Is., 1.5 mi. NW of Selvesen Pt.	53° 36.5'N	133° 1.5'W	Weight: ~500 lbs.; carapace length: 6 ft.			Stinson 1984
Sighting	Alive	1	probable	1983	8		La Perouse Bk., off	48° 30'N	125° 10'W	Length: 8 ft.			questionnaire
Sighting	Alive	1	certain	1983			Kains Is., 10 mi. off	50° 20'N	128° 15'W	Length: <5 ft.	Dark brown with prominent ridges on its back		questionnaire
Sighting	Alive	1	probable	1984			Hippa Is. & Rennell Snd. area	53° 24'N	132° 46'W				hotline/outreach
Sighting	Alive	1	certain	1984			Queen Charlotte Snd., at Bull Hbr.	50° 54'N	127° 56'W		Looked like 45-gallon drum floating in sloppy water. Gigantic with longitudinal ridges		hotline/outreach
Dead	Dead	1	certain	1985	2	14	Victoria, Oak Bay	48° 24'N	123° 18'W		Partial skeleton		RBCM # 1612; WBT Wildlife Data Centre
Sighting	Alive	1	certain	1985	7	1	Brooks Pen., 8 mi. W of San Josef Bay	50° 38'N	128° 33'W		Orange spot on head. Big with smooth back featuring longitudinal ridges, approx. 3 on each side.	Free swimming and diving	hotline/outreach
Sighting	Alive	1	certain	1985	7		Langara Is.	54° 13'N	133° 6'W		Head the size of a bucket.	Free swimming	hotline/outreach
Sighting	Alive	1	certain	1985	8		Kains Is., 5 mi. off	50° 23'N	128° 8'W	Length: 5 ft.	Dark color with prominent ridges on its back.		questionnaire
Sighting	Alive	1	certain	1985	8		NW Vancouver Is., 40 mi. off	50° 20'N	129° 5'W	Length: 4-5 ft.			questionnaire
Sighting	Alive	1	certain	1985			Cape Cook, S of	49° 55'N	127° 50'W				questionnaire
Sighting	Alive	1	certain	1985			Ucluelet, SE	48° 40'N	125° 30'W				questionnaire
Entanglement	Alive	1	probable	1986	7		Skeena River, mouth of	54° 7'N	130° 19'W	Weight: >1000 lbs.	Very large.		hotline/outreach
Entanglement	Alive	1	probable	1986	8	10	Nootka Snd., entrance to	49° 32'N	126° 40'W	Carapace length: ~8 ft.; head & neck length: ~3 ft.	Very large.		hotline/outreach
Sighting	Alive	1	certain	1986	8	12	Sea Otter Cove , 30 mi. S of	50° 10'N	128° 20'W	Length: 8 ft.			questionnaire
Sighting	Alive	1	probable	1986			Hippa Is. & Rennell Snd. area	53° 24'N	132° 46'W				hotline/outreach
Sighting	Alive	1	certain	1988			Hippa Is. & Rennell Snd. area	53° 24'N	132° 46'W				hotline/outreach

APPENDIX B - Unique leatherback turtle sightings

Event Type	Animal Status	# Turtles	ID Confidence	Year	Month	Day	Sighting Location	Latitude	Longitude	Size Description	Physical Description	Behaviour	Source
Entanglement	Alive	1	probable	1989	9	1	Carmannah Pt., 2.5 mi. offshore of lightstation	48° 36'N	124° 49'W		Huge turtle.		hotline/outreach
Dead	Dead	1	probable	1989			Queen Charlotte Is., one of the 3 Is.s on S tip	51° 55'N	130° 59'W				hotline/outreach
Entanglement	Alive	1	certain	1989			Nitnat	48° 38'N	124° 56'W		Very large, ridges on leathery back	After untangled, it lifted its head up and had a huge gasp for air, then swam off.	hotline/outreach
Sighting	Alive	1	certain	1989			Cape Beale, at "7 mile Bk."	48° 40'N	125° 19'W				questionnaire
Sighting	Alive	1	probable	1990			Hippa Is. & Rennell Snd.	53° 29'N	132° 59'W				hotline/outreach
Sighting	Alive	1	certain	1992	7		Estevan , 10 mi. S of	49° 12'N	126° 30'W	Length: 5 ft.			questionnaire
Sighting	Alive	1	certain	1992	7		Triangle Is., S of	50° 40'N	129° 5'W	Length: 4-5 ft.			questionnaire
Sighting	Alive	1	certain	1992	8	20	Scott Is.s - 10 km. S of Triangle Is.	50° 45'N	129° 4'W	Length: 5 ft.			hotline/outreach; questionnaire
Sighting	Alive	1	probable	1992	10		Langara Is., 18 mi. NW offshore on continental shelf	54° 19'N	133° 36'W	Length: 6-8 ft.		"Calmly paddling along"	hotline/Outreach
Sighting	Alive	1	certain	1993	8		Brooks Pen., Clerke Pt.	50° 5'N	127° 48'W			Feeding on Cyanea	McAlpine et al. 2004
Sighting	Alive	1	certain	1993	9	9	Esperanza, offshore	50° 9'N	129° 49'W	Length: 7-9 ft.	Dark brown with ridges		questionnaire
Sighting	Alive	1	probable	1994	8	9	mid Hecate Strait, approx 50 mi. S of Sandspit's latitude	52° 26'N	130° 26'W	Carapace length: 6-7 ft.		Not intimidated by vessel	hotline/outreach
Sighting	Alive	1	certain	1996	5	26	Victoria, Mount Douglas Pk.	48° 30'N	123° 18'W				Curtis 1996; McAlpine et al. 2004
Sighting	Alive	1	certain	1996	6		Cape Scott, 2 mi. SW of	50° 10'N	128° 28'W	Length: 5 ft.			questionnaire
Sighting	Alive	1	certain	1996	7	10	Queen Charlotte Snd.	51° 18'N	129° 2'W			Free swimming near top of quiet water	WBT Wildlife Data Centre
Sighting	Alive	1	certain	1996	8		Brooks Pen., E side at the Shelter Shed	50° 4'N	127° 46'W			Turtle was eating large orange jellyfish.	questionnaire
Sighting	Alive	1	certain	1996	9		Brooks Pen., 50 mi. off Cape Cook on tuna grounds	50° 5'N	129° 15'W	Length: 6 ft.; width: 3-4 ft.	Long tail with "prehistoric" looking ridges. Large head.	Free swimming	hotline/outreach
Dead	Dead	1	certain	1997	6	1	Kyuquot	50° 5'N	127° 13'W		Carcass was pretty fresh, some skin missing but body and eyes in tact. Black in colour, spotted white as approach underside of body and on lower jaw.		McAlpine et al. 2004; hotline/outreach
Sighting	Alive	1	probable	1997	7		Cape Beale, 10-12 mi. SW	48° 37'N	125° 21'W	Carapace length: ~8 ft.; width: 4.5-5 ft.; head width: ~18 in.		Lifted head 3 feet out of water.	hotline/outreach
Sighting	Alive	1	certain	1997	9		Langara Is., SE	54° 12'N	132° 58'W			Free swimming	McAlpine et al. 2004; hotline/outreach
Dead	Dead	1	certain	1998	2	1	Dixon Entrance, inside the "Gully"	54° 15'N	131° 1.5'W	Carapace length: ~3 ft.	"It was a big mother". No head present.		hotline/outreach
Dead	Dead	1	certain	1998	5		Tofino, Tonquin Beach	49° 7'N	125° 53'W		Decomposed carcass		McAlpine et al. 2004; hotline/outreach
Sighting	Alive	1	probable	1999	4	20	Tofino, W of Cleland Is.	49° 10'N	126° 5'W			Swimming slowly at surface	WBT Wildlife Data Centre
Sighting	Alive	1	certain	1999	6	10	W Vancouver Is. W at the "Fence", 55 mi. straight out from Carmanah Pt at edge of Cdn EEZ	48° 10'N	125° 57'W				hotline/outreach
Collision	Alive	1	certain	1999	7	24	Barkley Snd., Kirby Pt., 100 yds. from shore	48° 51'N	125° 12.5'W	Length: 6-7 ft.; width: 8 ft.	Mottled colour like grey whale. Size of the top of a Volkswagon Beetle coming up from underwater.	Never broke the surface of water.	hotline/outreach
Sighting	Alive	1	probable	2000	6	27	Vargas Is. 3 mi. off	49° 8'N	126° 5'W	Carapace length: >3 ft.			hotline/outreach
Sighting	Alive	1	certain	2000	8		Cape St. James, W of	51° 53'N	130° 52'W	Length: 8 ft.	Brown color, leathery back		questionnaire

APPENDIX B - Unique leatherback turtle sightings

Event Type	Animal Status	# Turtles	ID Confidence	Year	Month	Day	Sighting Location	Latitude	Longitude	Size Description	Physical Description	Behaviour	Source
Sighting	Alive	1	certain	2000	8		Top Knot Pt., 60 mi. S of	49° 32'N	128° 13'W	Length: 8 ft.		Approached boat	questionnaire
Sighting	Alive	1	certain	2000	9	6	Estevan Pt., 100 km. WSW offshore	48° 43'N	127° 28'W		Ridges on back	Free swimming - lifting head	McAlpine et al. 2004; hotline/outreach
Sighting	Alive	1	certain	2001	4		Nootka Snd., Friendly Cove	49° 35'N	126° 36'W		Very large. Ridges on back.	Free swimming	hotline/outreach
Entanglement	Dead	1	certain	2001	7		Cape St. James	51° 55'N	131° 0'W	Legnth: 9 ft.			questionnaire
Dead	Dead	1	certain	2001	7		Tonquin Beach	49° 7'N	125° 55'W		Big shell with ridges	Dead	questionnaire
Sighting	Alive	1	certain	2001	8	4	Langara Is.	54° 18'N	133° 10'W				McAlpine et al. 2004
Dead	Dead	1	certain	2001	8	12	Darwin Snd., Shuttle Is.	52° 39'N	131° 40'W	Length: 6-7 ft.	Eyes missing but in good shape. Black-ish shell. Exactly like carapace speciment at Vancouver Aquarium.		questionnaire
Sighting	Alive	1	probable	2001	9	8	Quatsino Snd., Rupert In., in small bay between camp and log sort	50° 34'N	127° 30'W	Width: 2 ft.			hotline/outreach
Sighting	Alive	1	certain	2002	5		Nootka Is., 35 mi. off	49° 0'N	127° 5'W	Length: 6.5 ft.			questionnaire
Sighting	Alive	1	certain	2003	7	29	Laskeek Bay, 10 mi. S of Reef Is.	52° 42'N	131° 23'W		Quite large, greenish-grey, pointed body shape.	Free swimming. Large flippers breaking surface as swimming.	hotline/outreach
Sighting	Alive	1	certain	2003	8	6	Queen Charlotte Is. SE	52° 20.23'N	130° 57.23'W			Appearde to be avoiding ship	survey
Sighting	Alive	1	probable	2003	8	8	NE Denman Is., Sandy Is.	49° 37'N	124° 50'W		Big and round-ish. Large flippers breaking surface of water	Turtle went under the boat. Came up slowly and contined to swim away.	hotline/outreach
Sighting	Alive	1	certain	2003	8	11	Juan Perez Snd., NE corner of Murchison Is., 3 mi. offshore	52° 37'N	131° 20'W		Somewhat pointy at back. Light greenish.	Free swimming. Did not react to plane circling. Swimming just under the water.	hotline/outreach
Sighting	Alive	1	certain	2003	8		Cape Beale, 45 nm. SW of	48° 10'N	125° 55'W	Length: 5 ft.			questionnaire
Sighting	Alive	1	certain	2003	8		W Vancouver Is	49° 0'N	127° 0'W				questionnaire
Sighting	Alive	1	probable	2004	5	30	Sooke, towards Otter Pt	48° 21.8'N	123° 47.5'W	Length: 6-7 ft.; head the size of a river otter's		Heading E, 150 metres from the beach. Travelling slow, a foot or two below the surface. urfaced every 20-30 seconds.	hotline/outreach
Sighting	Alive	1	probable	2004	6	21	Rennell Snd at Gospel Is, 1 mi. W of	53° 23'N	132° 38'W	Length: 8 ft.; Width: 5-6 ft.		Shallow dives between surfacings.	hotline/outreach
Sighting	Alive	1	certain	2004	7	6	Pine Is, 1 mi. W of	50° 58'N	127° 45'W	Length: ~9 ft.	Dark shell	10-15 sec. surface intervals. Lots of splashing upon surfacing.	hotline/outreach
Sighting	Alive	1	certain	2004	7	9	Lost Is., 1 mi. E of	52° 48'N	131° 24'W	Carapace length: 4-6 ft.	Dark colouration. Head was quite large.	Appeared to be resting - raised head, took gulps of air and then lay with the head submerged for 20 or 30 sec.	hotline/outreach
Sighting	Alive	1	certain	2004	7	20	Port Louis, towards Hippa Is	53° 37'N	133° 3'W	Length: 7-8 ft; width: 4 ft	Ridges on back.	Free swimming. Approached boat within 15 ft.	hotline/outreach
Sighting	Alive	1	certain	2004	7	28	Pachena Pt., 70 mi. E offshore	48° 42.774'N	126° 54.504'W	Length: >6 ft.; width: 4.5 ft.	Green-brown colour with lumps on its back; large head	Free swimming.	hotline/outreach
Sighting	Alive	1	probable	2004	8	9	Langara Is., 1 mi. off W side	54° 14'N	133° 7'W	Width: 8 ft. with flippers outstretched		Oscillated swimming above & below surface in 10-15 sec. intervals. Travelling slowly.	hotline/outreach
Sighting	Alive	1	certain	2004	8	16	Esperanza, 50 mi. W of	49° 44'N	128° 20'W	Bigger than car; head larger than a sea lion's	Very large turtle		hotline/outreach
Sighting	Alive	1	certain	2004	9	7	French Beach, Sooke	48° 22'N	123° 57'W	Length: 5-6 ft.	Large, dark shell. Pointed ridges on back, large head.	Lifting head/neck & flippers out of water a lot. Facing open water, seemed like moving backwards.	hotline/outreach

APPENDIX B - Unique leatherback turtle sightings

Event Type	Animal Status	# Turtles	ID Confidence	Year	Month	Day	Sighting Location	Latitude	Longitude	Size Description	Physical Description	Behaviour	Source
Dead	Dead	1	probable	2004	9	25	Amphitrite Pt., 10 nm. S of	48° 45.1'N	125° 31.175'W	Length: 5 ft.; width: 3 ft.	Advanced decomposition. Very white, with algal growth on tail.		hotline/outreach
Sighting	Alive	1	certain	2005	8	26	Houston Stewart Ch., 9 mi. W offshore	51° 57.71'N	131° 18.2'W	Length: ~4.5 ft.	Dark colour with distinct lateral ridges along back. Pink (pineal) spot on head covered in orange growth.		survey
Sighting	Alive	1	certain	2005	9	11	Langara Is., E of	54° 15'N	132° 55'W		Large and dark		hotline/outreach
Sighting	Alive	1	certain	2005	9	15	Dellwood Seamount, 100 mi. W of Triangle Is	50° 19.21'N	130° 56.5'W				hotline/outreach
Sighting	Alive	1	certain	2005	9	16	Dellwood Seamount, 100 mi. W of Triangle Is	50° 18.72'N	131° 14.091'W				hotline/outreach
Sighting	Alive	2	probable	2005	9	16	Dellwood Shoals, W of	50° 35'N	130° 40'W				hotline/outreach
Sighting	Alive	1	certain	2005	9	17	Dellwood Seamount, 100 mi. W of Triangle Is	50° 20'N	130° 46'W				survey
Sighting	Alive	1	certain	2007	8	11	SW Queen Charlotte Is.	51° 21'N	131° 10'W				hotline/outreach
Sighting	alive	1	certain	2007	10		Hornby Is., Galleon Beach on N side of Is.	49° 33'N	124° 40'W	Length: 5 ft.	Dark brown carapace. Steep slope at the top of the shell and segmented. Very long neck and tail.	Free swimming and dipping head into water	hotline/outreach
Sighting	Alive	1	certain	2008	8	7	Cape Beale, 80 nm. SW offshore	48° 2'N	127° 3'W		Large and dark grey	Free swimming at surface	hotline/outreach
Sighting	Alive	1	probable	2008	8	27	Lennard Is. Light, 11 nm. off	49° 1'N	126° 10'W	Carapace length: 5 ft.			hotline/outreach
sighting	alive	1	certain	2008	9	4	La Perouse Bk.	48° 42.248'N	125° 49.43'W				hotline/outreach
Sighting	Alive	1	probable	2008	9	25	Portland Pt., 3.4 nm. S of	49° 1'N	125° 53'W	Carapace length: 5 ft.			hotline/outreach
Sighting	Alive	1	certain	2009	9	11	Tofino, 70 nm. SW of	48° 21.33'N	129° 19.02'W			Free swimming	hotline/outreach
Sighting	Alive	1	certain		8		Cape Beale, 10 mi. off	48° 40'N	125° 25'W				questionnaire
Entanglement	Alive	1	probable				Hippa Is., near Nestle Is.	53° 32'N	132° 56'W				hotline/outreach
Sighting	Alive	1	probable				Houston Stewart Ch.	52° 9'N	131° 0'W				hotline/outreach
Entanglement	Alive	1	probable				Langara Is.	54° 18'N	133° 5'W				hotline/outreach
Sighting	Alive	6	probable				Vancouver Is., W , 80-320 km. offshore						hotline/outreach; McAlpine et al. 2004
Sighting	Alive	1	certain				Cape Cook, 6 mi. off	50° 7'N	128° 5'W		Extremely large		questionnaire
Sighting	Alive	1	certain				Ucluelet , 15 mi. SW of	48° 45'N	125° 45'W		Large		questionnaire

APPENDIX C - Unique unidentified sea turtle sightings

Event Type	Animal Status	# Turtles	Leatherback ID Confidence	Year	Month	Day	Sighting Location	Latitude	Longitude	Size Description	Physcial Description	Source
Sighting	Alive	1	Uncertain	1965			Cape Cook , Cape Scott				Large and green	hotline/outreach
Sighting	Alive		Uncertain	1976	6			51° 24.534'N	127° 51.413'W		Large and green	hotline/outreach
Sighting	Alive	1	Uncertain	1979	9		Skidegate Ch.	53° 13'N	131° 58'W			questionnaire
Sighting	Alive	1	Uncertain	1984	8		N. Vancouver Is.	49° 0'N	125° 0'W			questionnaire
Sighting	Dead	1	possible	1985	8		Clayoquot Snd., Ahousat	49° 16'N	126° 2'W	Length: 6 ft.		hotline/outreach
Sighting	Alive	1	uncertain	1985			Queen Charlotte Is., westcoast					questionnaire
Sighting	Alive	1	possible	1987	7	1	Queen Charlotte Is., W of	53° 2'N	133° 3'W			hotline/outreach
Sighting	Alive	1	Uncertain	1988	7		S British Columbia, 80-90 fms.	48° 20'N	125° 30'W		Green or Olive Ridley turtle	hotline/outreach
Sighting	Alive	1	uncertain	1989			Juan de Fuca Strait			Width: 4 ft.		questionnaire
Sighting	Alive	1	Uncertain	1990			west coast Vancouver Is	49° 0'N	126° 5'W	Length: ~8 ft.		hotline/outreach
Sighting	Alive	1	possible	1991	8		N. Vancouver Is.				Large and ugly looking	questionnaire
Sighting	Alive	1	uncertain	1992			Goose Bank, SW corner					questionnaire
Sighting	Alive	1	possible	1994	7		Brooks Pen.	50° 11'N	127° 58'W			hotline/outreach
Sighting	Alive	1	possible	1994			Brooks Pen., Cape Cook	50° 5'N	127° 0'W		Big	questionnaire
Sighting	Alive	1	possible	1995	8		Kyuquot, 5 mi. offshore at "Strawberry Patch" (between Kyuquot & Esperanza)	49° 52'N	127° 16'W			hotline/outreach
Sighting	Alive	1	Uncertain	1997	8		Quatsino Snd. - Off Kain's Is.				Large shell	hotline/outreach
Other	Dead		Uncertain	1998	6	6	Rennison Is., QCI (????? - see comments)	52° 49.781'N	129° 22.11'W	Carpace length: <1 m.	Hard shell, decomposed skeleton.	hotline/outreach
Sighting	Alive	1	uncertain	1998	8		Cape Cook, 50 nm W of				Dark colour	questionnaire
Sighting	Alive	1	possible	1998	9		Darby Ch. , Lone Is.	51° 31'N	127° 43'W	Width: 1.5 ft.		questionnaire
Sighting			Uncertain	1999			Nootka Snd.					hotline/outreach
Sighting	Alive	1	possible	2000	7		Nootka Snd., Bajo Rf.	49° 35'N	126° 48'W			hotline/outreach
Sighting	Alive	1	uncertain	2000	8		Nootka Snd., Yuquot					questionnaire
Dead	Dead	1	uncertain	2002	2		Tofino	49° 8'N	125° 55'W			questionnaire
Sighting	Alive	1	Uncertain	2003	7	22	Vancouver, Pt. Atkinson, 3/4 nm. offshore of	49° 20.555'N	123° 18.6'W			hotline/outreach
Other		1	Uncertain	2004	2	2	Rose Hrb., QCI					hotline/outreach
Sighting	Alive	1	Uncertain	2004	5	20	Pine Is. Lightstation, 1/2 mi. off	51° 58.3'N	127° 43.26'W			hotline/outreach
Sighting	Alive	1	possible	2004	5		Vancouver, Deep Cv	49° 20'N	122° 56'W		Beaked head, wider at base of head/neck	hotline/outreach
Sighting	Alive	1	Uncertain	2004	10	23	French Creek			Length: 3-3.5 ft.; neck length: ~1 ft.	Blunt head, beige to pea green colour. Unknown body shape.	hotline/outreach
Sighting	Alive	1	Uncertain	2006	6	2	Khutzeymateen In.					hotline/outreach
Sighting	Alive	1	possible	2007	6	3	Addenbroke Lightstation, 1/8 mi. abeam station	51° 36.208'N	127° 52.052'W			hotline/outreach
Sighting	Alive	1	possible	2007	8	19		48° 17.9'N	126° 19.3'W	Weight: ~500-1000 lbs.		hotline/outreach
Sighting	Alive		Uncertain	2008	6	27	Cape Beale, 6.5 nm. WSW	48° 31'N	126° 43'W			hotline/outreach
Sighting	Alive	1	possible		8		Sea Otter Cv.	50° 41'N	128° 21'W			questionnaire
Sighting	Alive	many	uncertain		8		West coast Vancouver Is., at 500 fa edge					questionnaire
Sighting	Alive	1	uncertain				QCI, eastcoast					questionnaire
Sighting	Alive	many	uncertain				West coast Vancouver Is.					questionnaire